

WHAT IS CLAIMED:

- 1 1. A method of treating a metal to improve the
2 metal's corrosion resistance, said method comprising:
3 applying, to the surface of the metal, a
4 coating which comprises magnesium powder and a binder.
- 1 2. A method according to claim 1, wherein the
2 coating is substantially free of chromium.
- 1 3. A method according to claim 1, wherein the
2 coating does not comprise added chromium.
- 1 4. A method according to claim 1, wherein the
2 metal is aluminum or an aluminum alloy.
- 1 5. A method according to claim 4, wherein the
2 metal is an aluminum alloy.
- 1 6. A method according to claim 5, wherein the
2 aluminum alloy is a copper-containing aluminum alloy.
- 1 7. A method according to claim 6, wherein the
2 copper-containing aluminum alloy is Al 2024 T-3.
- 1 8. A method according to claim 6, wherein the
2 copper-containing aluminum alloy is Al 7075 T-6.
- 1 9. A method according to claim 1, wherein the
2 magnesium powder comprises a mixture of a first magnesium
3 particle powder and a second magnesium particle powder,
4 wherein the first magnesium particle powder and a second
5 magnesium particle powder have substantially different

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6 mean particle size distributions, wherein the mixture's
7 bulk density is greater than the first magnesium particle
8 powder's bulk density, and wherein the mixture's bulk
9 density is greater than the second magnesium particle
10 powder's bulk density.

1 10. A method according to claim 9, wherein the
2 first magnesium particle powder has a mean particle size
3 distribution of from about 25 μ m to about 35 μ m and wherein
4 the second magnesium particle powder has a mean particle
5 size distribution of from about 65 μ m to about 75 μ m.

1 11. A method according to claim 10, wherein
2 the first magnesium particle powder has a mean particle
3 size distribution of about 30 μ m and wherein the second
4 magnesium particle powder has a mean particle size
5 distribution of from about 70 μ m.

1 12. A method according to claim 10, wherein
2 the mixture contains first magnesium particle powder and
3 second magnesium particle powder in a volume ratio of
4 from about 40:60 to about 60:40.

1 13. A method according to claim 10, wherein
2 the mixture contains first magnesium particle powder and
3 second magnesium particle powder in a volume ratio of
4 from about 45:55 to about 55:45.

1 14. A method according to claim 10, wherein
2 the mixture contains first magnesium particle powder and
3 second magnesium particle powder in a volume ratio of
4 from about 50:50 to about 55:45.

1 15. A method according to claim 14, wherein
2 the first magnesium particle powder has a mean particle
3 size distribution of about 30 μ m and wherein the second
4 magnesium particle powder has a mean particle size
5 distribution of from about 70 μ m.

1 16. A method according to claim 15, wherein
2 the mixture contains first magnesium particle powder and
3 second magnesium particle powder in a volume ratio of
4 about 58:42.

1 17. A method according to claim 1, wherein the
2 binder is a polymeric binder.

1 18. A method according to claim 17, wherein
2 the polymeric binder comprises a polyisocyanate
3 prepolymer and an epoxy prepolymer.

1 19. A method according to claim 18, wherein
2 the polyisocyanate prepolymer is an aliphatic
3 polyisocyanate prepolymer.

1 20. A method according to claim 18, wherein
2 the polyisocyanate prepolymer is an aromatic
3 polyisocyanate prepolymer.

1 21. A method according to claim 18, wherein
2 the polymeric binder comprises a polyisocyanate
3 prepolymer and an epoxy prepolymer and wherein said
4 method further comprises contacting the polymeric binder
5 with a crosslinker.

1 22. A method according to claim 21, wherein
2 the crosslinker is a silanated tetrahydroquinoxalinol.

1 23. A method according to claim 21, wherein
2 the crosslinker is a 7-phenyl-1-[4-(trialkylsilyl)-
3 alkyl]-1,2,3,4-tetrahydroquinoxalin-6-ol.

1 24. A method according to claim 21, wherein
2 the crosslinker is a 7-phenyl-1-[4-(trialkylsilyl)-
3 butyl]-1,2,3,4-tetrahydroquinoxalin-6-ol.

1 25. A method according to claim 1, wherein,
2 prior to said applying, said method further comprises:
3 contacting the metal surface with an amine-
4 containing organo-silane.

1 26. A method according to claim 25, wherein
2 the amine-containing organo-silane is (N- β -(aminoethyl)-
3 γ -aminopropyltrimethoxysilane.

1 27. A method according to claim 25, wherein
2 said contacting the metal surface with an amine-
3 containing organo-silane produces an amine-containing
4 organo-silane treated metal surface and wherein, prior to
5 said applying, said method further comprises:
6 contacting the amine-containing organo-silane
7 treated metal surface with a polyisocyanate prepolymer.

1 28. A method according to claim 17, wherein
2 the polymeric binder is a silane modified epoxy
3 isocyanate hybrid.

1 29. A method according to claim 17, wherein
2 the polymeric binder is a polymeric material containing
3 polyurea, polyurethane, epoxy-amine, and organo-silane
4 linkages.

1 30. A method according to claim 1, wherein the
2 magnesium powder is a powder of a magnesium alloy
3 comprising (i) magnesium and (ii) calcium, manganese,
4 lithium, carbon, zinc, potassium, aluminum, and/or a rare
5 earth metal.

1 31. A method according to claim 1, wherein the
2 magnesium powder is a powder of a magnesium alloy
3 comprising (i) magnesium and (ii) manganese.

1 32. A method according to claim 1, wherein
2 said method further comprises pretreating the surface of
3 the metal with cerium ion.

1 33. A method according to claim 1, wherein the
2 metal is in the form of a sheet in physical contact with
3 a metal fastener wherein the sheet and fastener are made
4 of different metals and wherein the coating is applied to
5 the surface of both the sheet and the fastener.

1 34. A method according to claim 1, wherein the
2 magnesium powder is magnesium flake.

1 35. A coating composition comprising:
2 magnesium powder; and
3 a silane modified epoxy isocyanate hybrid
4 polymer or prepolymer.

1 36. A coating composition according to claim
2 35, wherein said magnesium powder is substantially
3 uniformly dispersed in said silane modified epoxy
4 isocyanate hybrid polymer or prepolymer.

1 37. A coating composition according to claim
2 35, wherein said magnesium powder comprises a mixture of
3 a first magnesium particle powder and a second magnesium
4 particle powder, wherein the first magnesium particle
5 powder and a second magnesium particle powder have
6 substantially different mean particle size distributions,
7 wherein the mixture's bulk density is greater than that
8 of the first magnesium particle powder's bulk density,
9 and wherein the mixture's bulk density is greater than
10 that of the second magnesium particle powder's bulk
11 density.

1 38. A coating composition according to claim
2 37, wherein the first magnesium particle powder has a
3 mean particle size distribution of from about 25 μ m to
4 about 35 μ m and wherein the second magnesium particle
5 powder has a mean particle size distribution of from
6 about 65 μ m to about 75 μ m.

1 39. A coating composition according to claim
2 38, wherein the first magnesium particle powder has a
3 mean particle size distribution of about 30 μ m and wherein
4 the second magnesium particle powder has a mean particle
5 size distribution of from about 70 μ m.

1 40. A coating composition according to claim
2 38, wherein the mixture contains first magnesium particle

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3 powder and second magnesium particle powder in a volume
4 ratio of from about 40:60 to about 60:40.

1 41. A coating composition according to claim
2 38, wherein the mixture contains first magnesium particle
3 powder and second magnesium particle powder in a volume
4 ratio of from about 45:55 to about 55:45.

1 42. A coating composition according to claim
2 38, wherein the mixture contains first magnesium particle
3 powder and second magnesium particle powder in a volume
4 ratio of from about 50:50 to about 55:45.

1 43. A coating composition according to claim
2 42, wherein the first magnesium particle powder has a
3 mean particle size distribution of about 30 μ m and wherein
4 the second magnesium particle powder has a mean particle
5 size distribution of from about 70 μ m.

1 44. A coating composition according to claim
2 43, wherein the mixture contains first magnesium particle
3 powder and second magnesium particle powder in a volume
4 ratio of about 58:42.

1 45. A coating composition according to claim
2 35, wherein said silane modified epoxy isocyanate hybrid
3 polymer or prepolymer comprises a polyisocyanate
4 prepolymer, an epoxy prepolymer, and a silanated
5 tetrahydroquinoxalinol crosslinker or a polymerization
6 product thereof.

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1 46. A coating composition according to claim
2 45, wherein the polyisocyanate prepolymer is an aliphatic
3 polyisocyanate prepolymer.

1 47. A coating composition according to claim
2 45, wherein the polyisocyanate prepolymer is an aromatic
3 polyisocyanate prepolymer.

1 48. A coating composition according to claim
2 45, wherein the silanated tetrahydroquinoxalinol
3 crosslinker is a 7-phenyl-1-[4-(trialkylsilyl)-alkyl]-
4 1,2,3,4-tetrahydroquinoxalin-6-ol.

1 49. A coating composition according to claim
2 45, wherein the silanated tetrahydroquinoxalinol
3 crosslinker is a 7-phenyl-1-[4-(trialkylsilyl)-butyl]-
4 1,2,3,4-tetrahydroquinoxalin-6-ol.